ABSTARCT

This study will investigate the green synthesis, characterization, and evaluation of doped and composite metal oxide nanoparticles (NPs) using a water bath. Plant extracts from various medicinal and wild species such as *Parthenium hysterophorus*, *Boehmeria macrophylla*, *Melia azedarach*, *Vitex negundo,* and *Dodonaea viscose* will be explored as eco-friendly reducing and stabilizing agents for the green synthesis of metal oxide NPs. These plants are rich in bioactive compounds that facilitate NPs formation in a sustainable and cost-effective manner. Doping with rare earth metals will be employed to enhance the physicochemical properties of the NPs. The synthesized NPs will be characterized using techniques such as X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), and UV Vis spectroscopy to analyze their structural, morphological, and optical features. Their photocatalytic degradation efficiency and antioxidant activities will be assessed to explore potential environmental and biomedical applications. This green synthesis approach is expected to offer a sustainable and cost-effective method to produce advanced nonmaterial with improved functionalities.

Keywords: Water bath, Green synthesis, metal oxide nanoparticles, rare earth doping, composite nanoparticles, photocatalytic activity, antioxidant activity, plant extracts.